The MRFIC Line

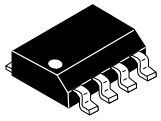
1.9 GHz GaAs Low Noise Amplifier

MRFIC1808

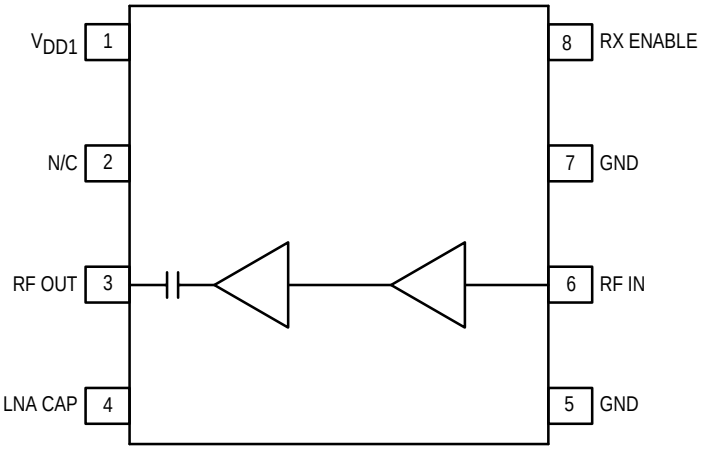
1.9 GHz GaAs LOW NOISE AMPLIFIER

Designed primarily for use in wireless Personal Communication Systems (PCS) applications such as Digital European Cordless Telephone (DECT), Japan's Personal Handy System (PHS) and the emerging North American systems as a preamp for discrete or integrated downmixers. The MRFIC1808 is a two–stage low noise amplifier in a low–cost SO–8 package. The amplifier can be matched to optimize gain or noise figure with simple off–chip input matching. The design employs a novel stacked MESFET design which reuses bias current for the highest gain at minimal current. A CMOS compatible RECEIVE ENABLE pin allows for very low standby current while the system is in transmit mode.

- Usable Frequency Range = 1.7 to 2.1 GHz
- 19 dB Typ Gain
- 1.6 dB Typ Noise Figure
- Simple Off–chip Matching for Maximum Gain/Noise Figure Flexibility
- High Reverse Isolation = –34 dB (Typ)
- Low Power Consumption = 13 mW (Typ)
- Single Bias Supply = 2.7 to 4.5 Volts
- Low Standby Current = 8 μA (Typ)
- Low Cost Surface Mount Plastic Package
- Order MRFIC1808R2 forTape and Reel.
  R2 Suffix = 2,500 Units per 16 mm, 13 inch Reel.
- Device Marking = M1808



CASE 751–05
(SO–8)



Pin Connections and Functional Block Diagram

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MOTOROLA

MAXIMUM RATINGS (T_A = 25°C unless otherwise noted)

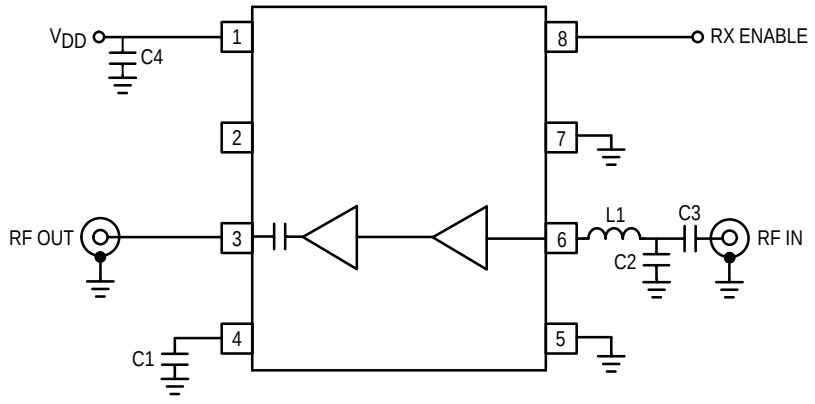
Rating	Symbol	Limit	Unit
Supply Voltage	V_{DD}	5.5	Vdc
RF Input Power	P_{RF}	3	dBm
Enable Voltage	RX ENABLE	5.5	Vdc
Storage Temperature Range	T_{stg}	– 65 to +150	°C
Operating Ambient Temperature	T_A	– 30 to +85	°C

RECOMMENDED OPERATING RANGES

Parameter	Symbol	Value	Unit
RF Frequency	f_{RF}	1.7 to 2.1	GHz
Supply Voltage	V_{DD}	2.7 to 4.5	Vdc
RX Enable Voltage, ON	RX ENABLE	2.7 to V_{DD}	Vdc
RX Enable Voltage, OFF	RX ENABLE	0 to 0.2	Vdc

ELECTRICAL CHARACTERISTICS (V_{DD} = 3 V, T_A = 25°C, RF = 1.9 GHz, RX ENABLE = 3 V, Tested in Circuit Shown in Figure 1)

Characteristic	Min	Typ	Max	Unit
RF Gain	16.0	19	—	dB
SSB Noise Figure	—	1.6	—	dB
RF Output 3rd Order Intercept Point	—	13	—	dBm
Output 1 dB Gain Compression	–3.0	1	—	dBm
Reverse Isolation (s_{12})	—	–34	—	dB
Input Return Loss	—	–12	—	dB
Output Return Loss	—	–15	—	dB
Supply Current RX Mode	—	4.2	6.5	mA
Supply Current Standby Mode (RX ENABLE = 0 V)	—	8	25	μA



C1 2 pF
C2 1.8 pF
C3, C4 22 pF
L1 5.6 nH

Figure 1. Applications Circuit Configuration

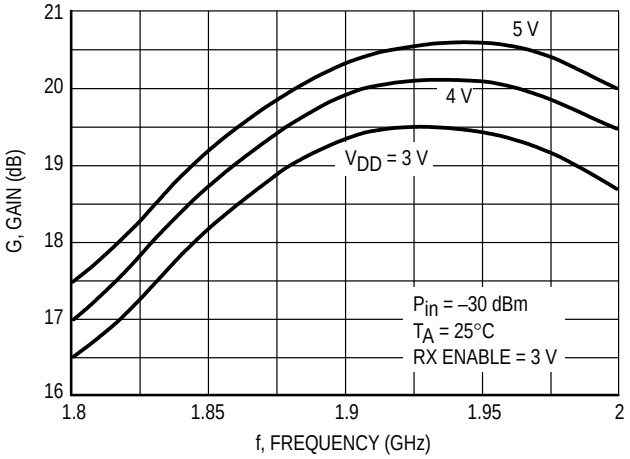


Figure 2. Gain versus Frequency

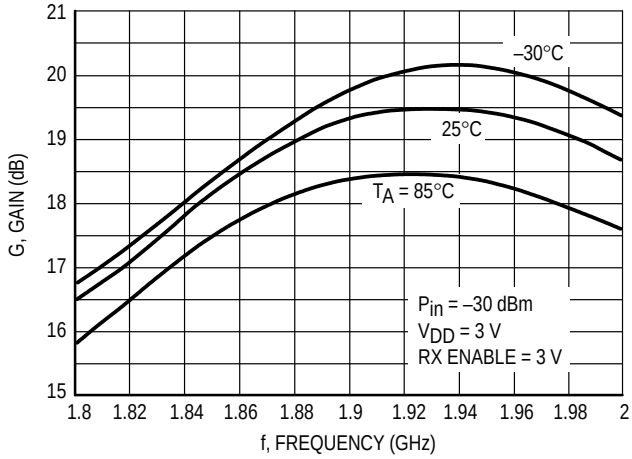


Figure 3. Gain versus Frequency

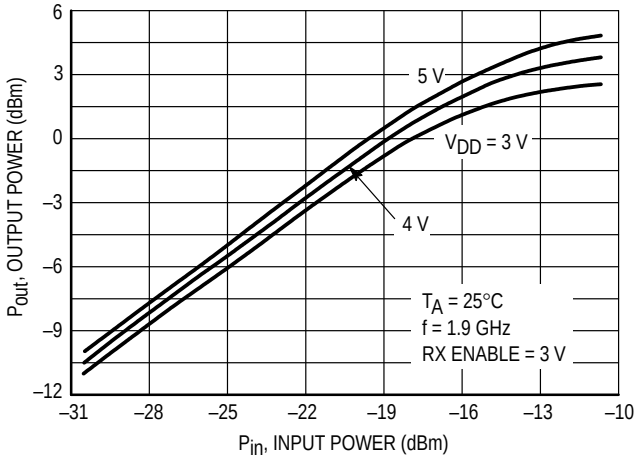


Figure 4. Output Power versus Input Power

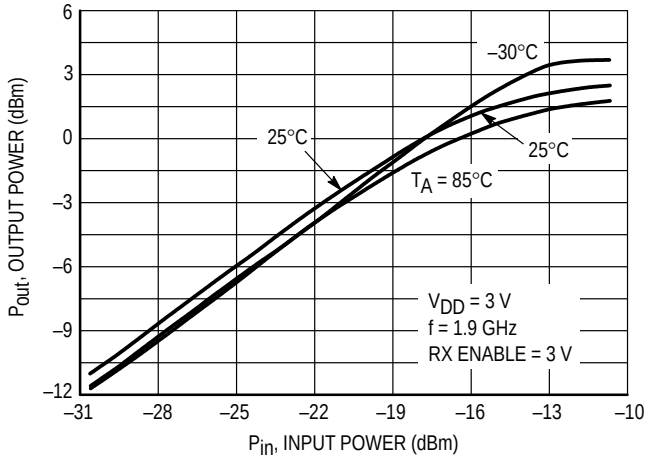


Figure 5. Output Power versus Input Power

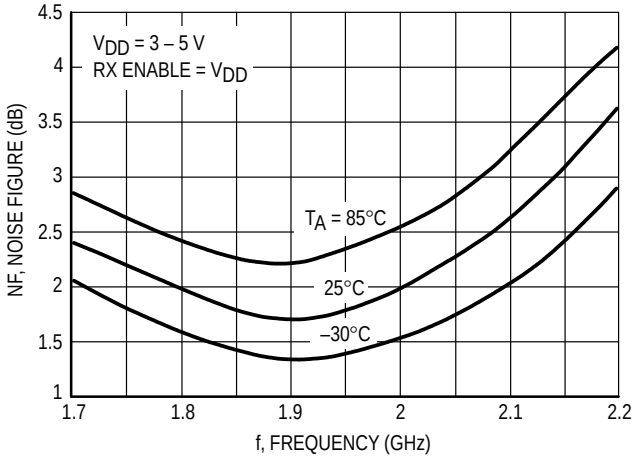


Figure 6. Noise Figure versus Frequency

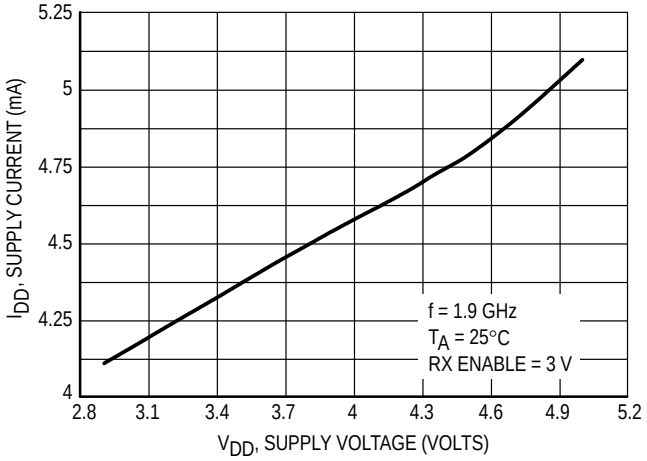


Figure 7. Supply Current versus Voltage

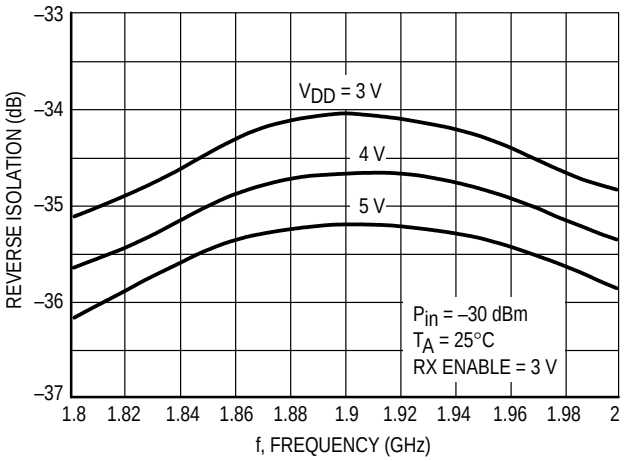


Figure 8. Reverse Isolation versus Frequency

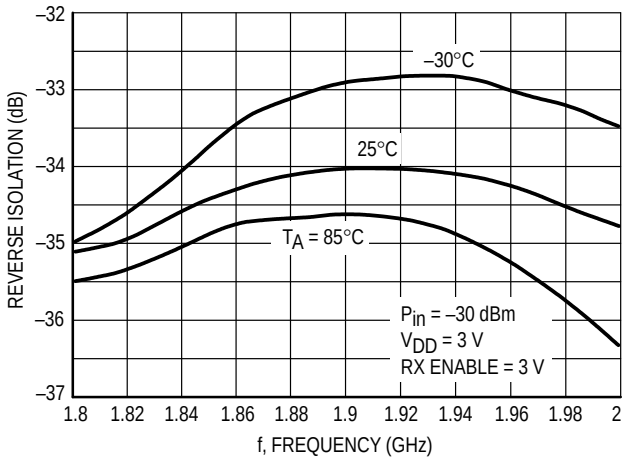


Figure 9. Reverse Isolation versus Frequency

Table 1. Scattering Parameters (V_{DD} = 3 Volts, T_A = 25°C, RX ENABLE = 3 Volts, 50 Ω System)

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
	$\|S_{11}\|$	∠ϕ	$\|S_{21}\|$	∠ϕ	$\|S_{12}\|$	∠ϕ	$\|S_{22}\|$	∠ϕ
1500	0.859	–40.95	2.58	139.07	0.013	103.72	0.583	–79.05
1530	0.870	–41.50	2.79	134.79	0.013	105.63	0.530	–80.94
1560	0.866	–42.06	3.01	130.60	0.013	99.14	0.474	–82.85
1590	0.871	–42.92	3.18	125.11	0.014	98.40	0.412	–83.57
1620	0.873	–43.47	3.30	118.70	0.012	98.00	0.348	–83.11
1650	0.876	–43.60	3.37	112.85	0.012	97.39	0.285	–80.54
1680	0.877	–44.86	3.52	106.23	0.012	92.68	0.229	–73.01
1710	0.880	–45.35	3.68	100.77	0.011	93.90	0.186	–60.35
1740	0.876	–46.03	3.80	94.40	0.012	93.12	0.168	–40.74
1770	0.876	–47.22	3.87	88.75	0.011	88.55	0.182	–20.50
1800	0.885	–48.69	3.98	82.96	0.010	88.40	0.221	–6.82
1830	0.879	–48.55	3.98	76.83	0.010	89.46	0.272	–0.29
1860	0.881	–49.87	3.98	71.11	0.009	94.75	0.324	3.05
1890	0.885	–50.71	4.00	66.38	0.009	97.00	0.376	4.39
1920	0.878	–51.81	4.09	61.64	0.009	88.22	0.425	4.25
1950	0.873	–52.42	4.19	56.66	0.008	87.57	0.474	3.79
1980	0.860	–52.98	4.15	51.32	0.007	88.75	0.522	2.22
2010	0.866	–54.24	3.98	44.93	0.006	100.17	0.564	0.85
2040	0.859	–56.12	3.85	40.93	0.005	87.86	0.599	–0.87
2070	0.861	–56.69	3.89	37.99	0.004	99.30	0.634	–3.01
2100	0.850	–57.79	4.04	35.71	0.004	98.94	0.661	–4.59
2130	0.844	–58.53	4.18	31.89	0.004	118.15	0.691	–6.96
2160	0.834	–60.21	4.21	26.88	0.003	137.84	0.714	–8.94
2190	0.834	–61.26	4.15	22.38	0.003	141.53	0.734	–11.49
2220	0.830	–62.53	4.17	18.75	0.004	–164.13	0.760	–13.48
2250	0.817	–63.84	4.22	14.85	0.004	–172.30	0.776	–15.27
2280	0.812	–64.69	4.21	9.17	0.005	–165.76	0.787	–17.20
2310	0.811	–66.64	4.14	4.09	0.006	–148.57	0.805	–19.42
2340	0.800	–67.89	3.95	1.20	0.007	–153.96	0.808	–21.63
2370	0.794	–69.40	3.83	0.29	0.008	–144.49	0.819	–23.38
2400	0.791	–72.05	3.88	0.33	0.009	–133.12	0.822	–26.10
2430	0.784	–73.59	4.09	–2.06	0.012	–138.06	0.826	–28.21
2460	0.774	–75.60	4.30	–8.63	0.014	–138.55	0.824	–30.43
2490	0.769	–78.81	4.33	–16.94	0.015	–146.05	0.821	–32.72
2520	0.751	–80.46	4.31	–23.37	0.018	–148.25	0.815	–35.42
2550	0.737	–83.20	4.23	–27.46	0.021	–149.08	0.798	–37.56
2580	0.707	–86.12	4.08	–32.67	0.024	–155.44	0.767	–39.31

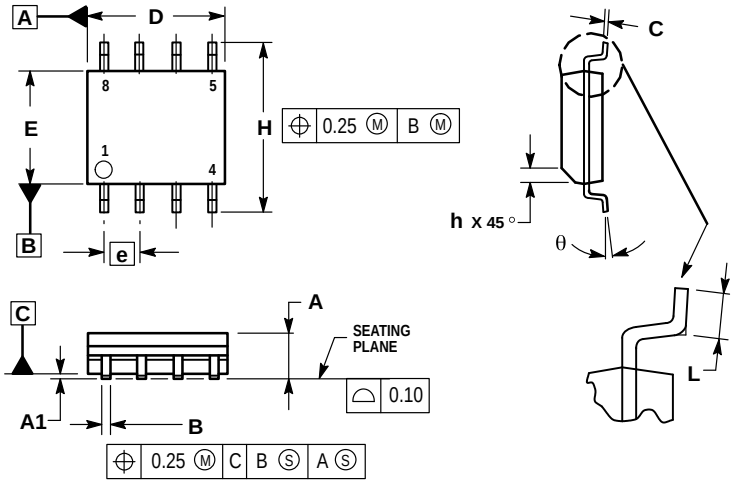
Table 2. Scattering Parameters (V_{DD} = 4 Volts, T_A = 25°C, RX ENABLE = 3 Volts, 50 Ω System)

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
	$\|S_{11}\|$	∠ϕ	$\|S_{21}\|$	∠ϕ	$\|S_{12}\|$	∠ϕ	$\|S_{22}\|$	∠ϕ
1500	0.849	–40.63	2.83	138.31	0.013	101.12	0.592	–78.76
1530	0.854	–41.00	3.07	134.02	0.012	99.54	0.537	–80.92
1560	0.852	–41.65	3.30	129.90	0.012	97.89	0.482	–82.91
1590	0.855	–42.76	3.50	124.44	0.013	103.09	0.421	–84.04
1620	0.861	–43.15	3.63	118.09	0.013	104.42	0.357	–84.20
1650	0.862	–43.22	3.73	112.01	0.012	95.75	0.293	–82.14
1680	0.861	–44.49	3.89	106.04	0.012	95.43	0.233	–75.91
1710	0.861	–44.93	4.07	100.17	0.011	99.73	0.187	–63.54
1740	0.869	–45.60	4.19	94.14	0.011	94.00	0.164	–43.94
1770	0.864	–46.48	4.30	87.75	0.011	95.67	0.173	–22.19
1800	0.870	–48.17	4.41	82.13	0.011	88.56	0.210	–7.42
1830	0.860	–48.09	4.41	75.97	0.010	88.92	0.258	0.31
1860	0.866	–49.28	4.41	70.37	0.010	96.31	0.313	3.91
1890	0.870	–50.19	4.46	65.24	0.009	93.39	0.367	5.28
1920	0.861	–50.75	4.54	60.65	0.008	90.74	0.417	5.60
1950	0.852	–51.77	4.66	55.96	0.008	89.58	0.468	4.75
1980	0.849	–52.40	4.56	50.46	0.007	84.42	0.518	3.22
2010	0.847	–53.50	4.40	44.25	0.006	94.48	0.561	1.68
2040	0.847	–55.19	4.25	39.96	0.005	88.62	0.597	–0.03
2070	0.847	–55.75	4.29	37.08	0.004	109.85	0.633	–2.25
2100	0.842	–56.92	4.47	34.67	0.005	103.26	0.664	–3.78
2130	0.830	–57.36	4.61	30.80	0.004	125.77	0.694	–6.23
2160	0.823	–59.26	4.66	26.03	0.004	122.00	0.717	–8.30
2190	0.820	–60.09	4.57	21.27	0.004	152.31	0.742	–10.87
2220	0.820	–61.37	4.57	17.70	0.002	160.02	0.762	–13.04
2250	0.812	–63.01	4.63	13.81	0.003	176.88	0.778	–14.80
2280	0.801	–63.88	4.61	8.47	0.004	–165.16	0.792	–17.00
2310	0.802	–65.68	4.54	2.90	0.005	–156.21	0.807	–19.20
2340	0.789	–67.07	4.32	0.38	0.007	–141.83	0.815	–21.21
2370	0.781	–68.28	4.21	–1.24	0.008	–144.89	0.821	–23.34
2400	0.775	–70.61	4.23	–0.61	0.010	–143.18	0.826	–25.75
2430	0.771	–72.01	4.47	–2.85	0.012	–140.04	0.829	–28.07
2460	0.764	–74.59	4.70	–9.44	0.012	–144.28	0.829	–30.56
2490	0.759	–77.25	4.72	–17.93	0.015	–149.63	0.826	–32.63
2520	0.743	–78.88	4.69	–24.28	0.017	–148.60	0.820	–35.12
2550	0.730	–81.98	4.58	–28.44	0.021	–148.70	0.802	–37.38
2580	0.700	–85.55	4.45	–33.64	0.022	–157.99	0.772	–39.29

Table 3. Scattering Parameters (V_{DD} = 5 Volts, T_A = 25°C, RX ENABLE = 3 Volts, 50 Ω System)

f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
	$\|S_{11}\|$	∠ϕ	$\|S_{21}\|$	∠ϕ	$\|S_{12}\|$	∠ ϕ	$\|S_{22}\|$	∠ϕ
1500	0.830	–40.58	3.12	137.17	0.011	98.73	0.600	–78.51
1530	0.839	–41.24	3.39	132.69	0.011	101.93	0.548	–80.73
1560	0.836	–41.75	3.64	128.74	0.012	96.66	0.492	–82.85
1590	0.842	–42.35	3.85	123.33	0.013	99.33	0.433	–84.11
1620	0.848	–42.88	4.02	116.83	0.012	101.06	0.370	–84.63
1650	0.843	–43.41	4.11	110.95	0.012	95.15	0.306	–82.83
1680	0.844	–44.37	4.30	104.87	0.012	96.02	0.243	–77.32
1710	0.849	–45.07	4.49	99.42	0.012	96.86	0.193	–66.79
1740	0.852	–45.25	4.64	93.23	0.010	99.66	0.163	–48.45
1770	0.848	–46.18	4.75	87.02	0.012	88.90	0.164	–26.11
1800	0.856	–47.76	4.88	81.25	0.011	93.18	0.200	–9.04
1830	0.850	–47.99	4.87	75.09	0.010	90.25	0.247	–0.08
1860	0.850	–48.93	4.90	69.14	0.009	88.62	0.301	3.73
1890	0.849	–49.88	4.96	64.08	0.009	93.94	0.355	5.69
1920	0.846	–50.72	5.02	59.31	0.009	93.67	0.407	6.01
1950	0.837	–51.45	5.15	54.55	0.007	90.89	0.459	5.70
1980	0.830	–52.33	5.07	48.85	0.008	98.84	0.511	4.17
2010	0.831	–52.97	4.89	42.81	0.006	90.07	0.557	2.40
2040	0.831	–55.08	4.72	38.38	0.004	100.73	0.593	0.51
2070	0.829	–55.58	4.74	35.43	0.005	96.39	0.631	–1.55
2100	0.823	–56.53	4.95	32.95	0.004	122.68	0.661	–3.57
2130	0.815	–57.23	5.10	29.26	0.004	112.15	0.691	–5.96
2160	0.805	–58.81	5.14	24.21	0.004	132.80	0.718	–7.96
2190	0.802	–59.57	5.04	19.45	0.004	136.20	0.739	–10.56
2220	0.801	–60.70	5.05	15.80	0.003	178.25	0.762	–12.60
2250	0.791	–62.24	5.11	12.01	0.004	170.40	0.780	–14.52
2280	0.781	–62.95	5.08	6.42	0.005	–172.19	0.793	–16.63
2310	0.786	–64.98	4.97	1.09	0.006	–169.11	0.811	–18.96
2340	0.773	–66.05	4.74	–1.76	0.006	–150.31	0.818	–21.10
2370	0.766	–67.23	4.60	–2.91	0.008	–143.53	0.821	–23.29
2400	0.763	–69.83	4.64	–2.54	0.009	–146.46	0.827	–25.81
2430	0.757	–71.49	4.89	–4.89	0.011	–141.36	0.832	–27.88
2460	0.750	–73.61	5.12	–11.49	0.012	–147.16	0.832	–30.37
2490	0.742	–76.17	5.17	–19.88	0.014	–145.27	0.827	–32.68
2520	0.726	–78.01	5.10	–26.09	0.016	–145.14	0.820	–35.26
2550	0.712	–81.26	5.01	–30.13	0.018	–150.98	0.805	–37.48
2580	0.686	–84.54	4.81	–35.31	0.022	–155.55	0.771	–39.32

PACKAGE DIMENSIONS



NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION D AND E DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 PER SIDE.
5. DIMENSION B DOES NOT INCLUDE MOLD PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 TOTAL IN EXCESS OF THE B DIMENSION AT MAXIMUM MATERIAL CONDITION.

	MILLIMETERS	
DIM	MIN	MAX
A	1.35	1.75
A1	0.10	0.25
B	0.35	0.49
C	0.18	0.25
D	4.80	5.00
E	3.80	4.00
e	1.27 BSC	
H	5.80	6.20
h	0.25	0.50
L	0.40	1.25
θ	0 °	7 °

CASE 751–05
ISSUE S

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